

Microturbine CHP Application in the Hotel Business



**DOE Microturbine
Application Workshop
Embassy Suites Brea**

January 20, 2004



Who is PowerHouse Energy



- A Southern California based Distributor and Authorized Service Provider of both traditional and state-of-the-art energy products
- It's sole mission is to create a win-win solution for it's customers by reducing energy costs and increasing profits through the use of on-site generation equipment while never reducing the customer's security of supply
- PHE offers a variety of options for equipment ownership. It will install and service the equipment to insure seamless energy generation

Who is Embassy Suites

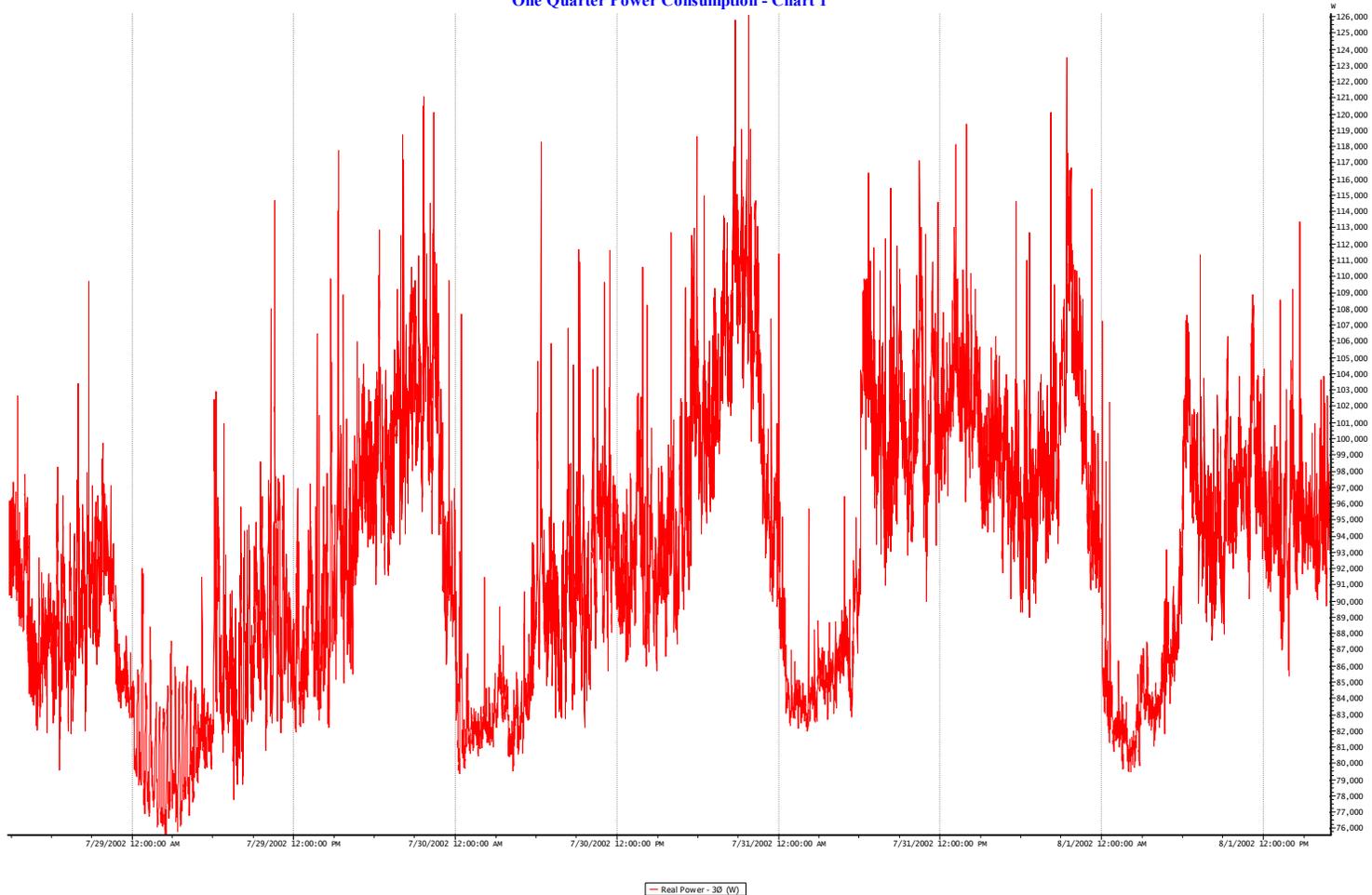


- Embassy Suites, Brea is a full service hotel in the central retail district
- They have 228 guest rooms with a 400 seat restaurant with conference/meeting rooms
- The hotel operates 24 hours X 7 days a week
- They have room heat pumps, central water heating, laundry, swimming pool and spa
- PHE partnered with the hotel in an energy service
- The hotel was interested in cost savings

Pre-CHP Electrical Load

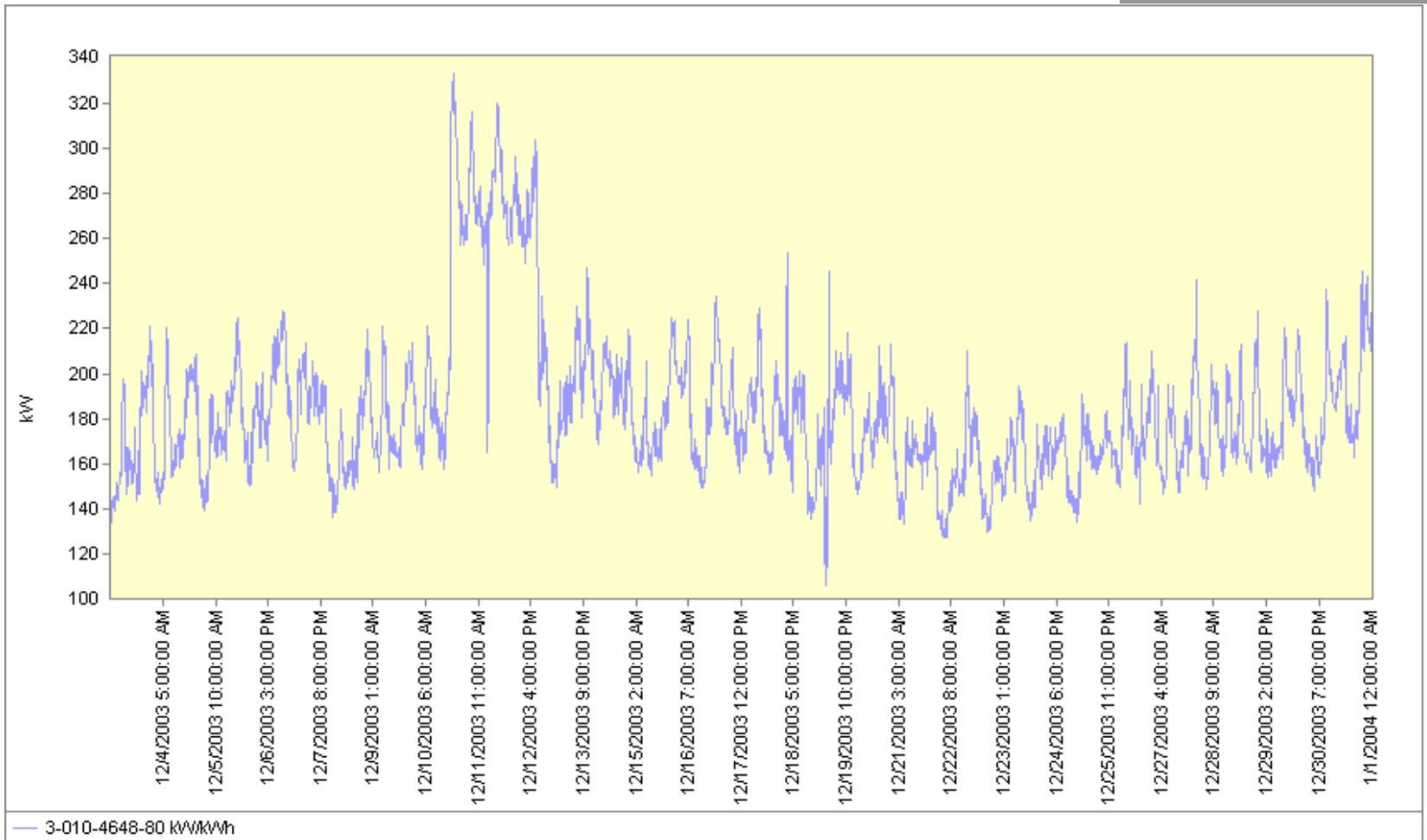


One Quarter Power Consumption - Chart 1



Start: 7/28/2002 2:46:07 PM End: 8/1/2002 5:02:07 PM
Test 4

Post CHP Installation



Progress Checklist



Process

1. PHE shares energy options and programs available today
2. CUSTOMER provides PHE with energy bills
3. PHE and CUSTOMER establish energy requirements for customer's business
4. PHE performs a site survey
5. PHE and CUSTOMER discuss project's technical and financial aspects
6. PHE develops project evaluation checklist
7. PHE prepares a preliminary report and meets with CUSTOMER to review project recommendations, costs, timing and evaluation checklist
8. CUSTOMER reviews preliminary report and makes decision to proceed
9. PHE monitors CUSTOMER'S energy use
10. PHE documents use and files utility rebate forms on CUSTOMER'S behalf
11. Financial, engineering and construction bids are obtained
12. CUSTOMER internally reviews ownership and leasing options
13. PHE produces final report and proposal and meets with CUSTOMER to review all project implementation details
14. PHE and CUSTOMER sign contract
15. PHE handles site engineering, construction procedures, and permitting
16. Construction and installation

Estimated Time

Numbers 1-3	=	1 week
Numbers 4-7	=	1 week
Numbers 8-9	=	2 weeks
Numbers 10-14	=	2 weeks
Number 15	=	2 months
Number 16	=	1 month

Project Schedule



Organization



- Project Management- Thom McMahon/
Installation, Ken Nilsson/Service
- Funded, Owned and Operated by PowerHouse
Energy
- Project Plan (Actual Date)
 - Equipment Delivery 12/2002(Same)
 - System Commissioned 3/2003(5/2003)
 - Monitoring Underway 5/2003(5/2003)

Pictures of Site



Pictures of Site



Installation Improvements



- Improvements this Site
 - Ventilation improvements
 - Metering equipment and pool heat interfaces as original installation
 - Selection of installation contractors
 - Poor fit of supplied package exhaust ducting
- Target Improvements-Volume Installations
 - Standard drawing packages
 - Experienced installation contractors
 - Volume material purchases

Project Cost Table



<u>Item</u>	<u>Actual</u>	<u>HindSight</u>	<u>50th Install</u>
Turbine	\$100,000	\$100,000	\$92,000
CHP Unit	Inc.	N/C	N/C
Mechanical	\$30,000	\$25,000	\$22,000
Electrical	\$25,000	\$23,000	\$21,000
Civil	\$2,000	\$2,000	\$2,000
Consulting	\$10,000	\$0	\$0
Engineering	\$4,000	\$4,000	\$2,500
Proj. Mgnt.	\$15,000	\$3,000	\$2,000
Total	\$186,000	\$157,000	\$141,500

Electrical Performance



- Hours of operation to Date 4000 & 4100
- Average Electrical Performance 26%
- 65,000kW/9,200 Therms (LHV) (Dec. 2003)
- Estimated Parasitic Losses in KW- 5kW/hr
- Power Quality Tests Done as required by Southern California Edison for Interconnection acceptance.

Thermal Performance



- Thermal Output used 420,000,Btu/hr
- Average water Delta T across HTX 12°F
- Average flow rate through HTX 70gpm
- CHP Efficiency 55%, (26%e+29%t)
- Expected Peak Total System Efficiency 70%
- Electrical 28%+ Thermal 40%
- Cooling system N/A

Emission Performance



- No emission testing has been done to date.
- Emissions appear to be in line with Capstone estimates.

O&M Performance



■ Availability

- The equipment was unavailable for 612 hours due to equipment failure, (2 units including site issues). Availability cumulative since start 94.4%. 15 site visits due to equipment, 15 due to data acquisition and site issues.

■ Cost of O&M (less fuel)

- The current estimate of annual O&M costs excluding hot end replacement in total costs is \$7,000 and 0.8cents/kWh, (2 units).

Institutional Experience



- Building department and electric utility interconnection approvals were required.
- Project management overhead costs associated with approvals were approximately \$2,500.
- No issues were encountered with either approval process.

Supplier Support



- PHE was the supplier that “turn keyed” the installation. Better understanding of radiant heat generation for ventilation of product would be helpful, ~70,000Btu/hr each w/gas compressor.
- Technical support was very good from Capstone with clear documentation.
- PHE is a Capstone Business Partner with a clear understanding of O&M costs.
- PHE took advantage of Capstone’s promotional two unit package with a 3-year back stop warranty of \$0.008/kWh costs.

General Experience



- Indoor installations need to account for radiant heat with ventilation. Tight space installations may not be able to accommodate product improvements.
- PHE has gone on to do several other hotel installations, honing design and contractor work. Current installation costs by PHE are now within 1-2% of planned or budget costs.
- Suggested development areas, monitoring capability of kW, thermal and gas use in unit. Reliability of electrical components.